(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 070 740**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **82303848.4**

(22) Date of filing: **20.07.82**

(51) Int. Cl.³: **G 03 G 15/20**

(30) Priority: **21.07.81 JP 114938/81**

(43) Date of publication of application: **26.01.83 Bulletin 83/4**

(84) Designated Contracting States: **DE FR GB NL**

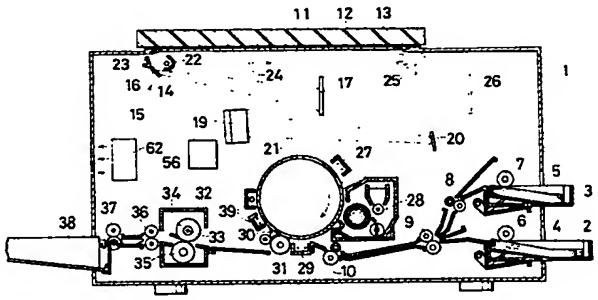
(71) Applicant: **MITA INDUSTRIAL CO. LTD., 2-28, 1-chome, Tamatsukuri Higashi-ku, Osaka (JP)**

(72) Inventor: **Iseki, Masahide, 2-28, Tamatsukuri, 1-chome, Higashi-ku Osaka (JP)**

(74) Representative: **Williams, Trevor John et al, J.A. KEMP & CO. 14 South Square Gray's Inn, London WC1R 5EU (GB)**

(54) Fixing and heating device for an electrostatic copying apparatus.

(57) A fixing and heating device of an electrostatic copying apparatus for fixing and heating a toner image onto a copy paper sheet by transporting the copy paper sheet through a set of fixing rollers 34, 35. The fixing and heating device 32 comprises means for controlling a means for driving the fixing rollers 34, 35 so as to energize a heater 33 in response to closing of a power switch and so as to drive the means for driving the fixing rollers 34, 35 in response to an output of the temperature detecting element 58 from the time when a temperature H of the fixing rollers 34, 35 reaches a predetermined temperature H3 to the time when the temperature H of the fixing rollers 34, 35 reaches a temperature H2 suitable for fixing, and while copying operation is going on after the temperature H of the fixing rollers 34, 35 has reached the temperature H2, wherein the temperature H3 is the same as or higher than a softening temperature H1 of toner and is lower than the temperature H2.



EP 0 070 740 A2

0070740

FIXING AND HEATING DEVICE FOR AN ELECTROSTATIC COPYING APPARATUS

The present invention relates to a fixing and heating device to be used for an electrostatic copying apparatus for heating and fixing a toner image on a copy paper sheet passed through a set of fixing rollers.

In one prior art arrangement, fixing rollers are driven to rotate at a relatively high speed suitable for fixing when a power switch is closed in an electrostatic copying apparatus. Before the power switch is closed, toner remains residually from a preceding copying operation and solidifies on the fixing rollers, and thereby a pair of the fixing rollers contact with each other. The fixing rollers rotate upon closing the power switch. At this time the fixing rollers are not heated at a softening temperature or a melting temperature of the toner and, therefore the solidified toner remaining on the fixing rollers injures the fixing rollers.

Another prior art arrangement comprises a scraper plate for scraping off the toner remaining on the fixing roller to prevent a copy paper sheet from winding around the fixing rollers. Since the fixing roller is driven to rotate before the solidified toner remaining between the surface of the fixing roller and the scraper plate is softened and melted,

the scraper plate is deformed by rotation of the fixing roller and the fixing roller is injured. The toner solidifying on the fixing roller and the scraper plate result in a sound occurring when the fixing roller begins to rotate. Rotation at a relatively high speed causes the fixing rollers to make a larger noise.

Still another prior art arrangement comprises a fixing roller which begins to rotate at a relatively high speed when the power switch is closed in the electrostatic copying apparatus, and the surfaces of the fixing rollers are heated at a temperature suitable for fixing. Once the fixing rollers are heated at the temperature suitable for fixing, they continuously rotate at a relatively high speed. Therfore, continuous rotation causes damage to the fixing roller and causes the fixing rollers to make sounds.

It is an object of the invention to provide a fixing and heating device to prevent the fixing rollers from being injured by residual toner on the fixing rollers.

Another object of the invention is to provide a new and improved fixing and heating device for fixing toner images on a copy paper sheet, by making temperature uniform, over all the peripheral surface of the fixing rollers, in time of a fixing operation.

Still another object of the invention is to provide the fixing and heating device to prevent the fixing rollers

from making sounds.

To accomplish the foregoing objectives, there is provided a fixing and heating device of an electrostatic copying apparatus according to the present invention. The fixing and heating device of the electrostatic copying apparatus comprises a temperature detecting element for detecting the temperature of the fixing rollers, a heater for heating the fixing rollers, means for driving the fixing rollers to rotate at a speed suitable for fixing, and means for controlling the means for driving the fixing rollers so as to energize the heater in response to closing of a power switch and so as to drive the means for driving the fixing rollers in response to an output of the temperature detecting element from the time when a temperature H of the fixing rollers reaches a predetermined temperature H3 to the time when the temperature H of the fixing rollers reaches a temperature H2 suitable for fixing, and while copying operation is going on after the temperature H of the fixing rollers has reached the temperature H2, wherein the temperature H3 is the same as or higher than a softening temperature Hl of toner and is lower than the temperature H2.

In accordance with the invention, since the fixing rollers are driven to rotate while the temperature H of the fixing rollers is the same as or higher than the softening temperature Hl of toner in a case when the temperature H

of the fixing rollers are lower than the temperature H2 suitable for fixing, the fixing rollers and so on are not injured by hardening toner adhered to the fixing rollers. In a case when the temperature H of the fixing rollers have reached the temperature H2 suitable for fixing, the fixing rollers are driven to rotate only while copying operation is going on. Accordingly, occurrence of the noise is decreased and the electric power consumption is decreased. Since the fixing rollers are driven to rotate at a speed suitable for fixing and heating, the mechanism for driving the fixing rollers can be simplified.

According to a preferred embodiment, the temperature detecting element is a thermistor, and is attached to the periphery of the heating roller at a central position in the axial direction of the heating roller at the opposite side of the press roller.

According to another preferred embodiment, the means for controlling the means for driving the fixing rollers controls the means for driving the fixing rollers in response to a signal from the power switch, an output from the temperature detecting element and a signal from a print button pushed at the beginning of copying operation.

A detailed description of the invention now will be made with reference to the accompanying drawings, wherein like numerals designate corresponding parts in the figures.

Fig. 1 is a schematic vertical cross-sectional view of an electrostatic copying apparatus having a fixing and heating device according to one embodiment of the present invention,

Fig. 2 is a side view of the fixing and heating device of one embodiment of the invention,

Fig. 3 is a partial perspective view of the fixing and heating device,

Fig. 4 is a schematic longitudinal sectional view taken along axes of a heating roller and a press roller,

Fig. 5 is a schematic block diagram taken in connection with a main motor, and

Fig. 6 is a graph showing a temperature of the heating roller which is detected by a temperature detecting element, being depended in the lapse of time.

Fig. 1 is a schematic vertical cross-sectional view of an electrostatic copying apparatus according to one preferred embodiment of the present invention. Copy paper sheets 4 and 5 in cassettes 2 and 3 provided at a side of a housing 1 are fed from the cassettes 2 and 3 by feeding rollers 6 and 7 alternatively one by one, and are transported by transport rollers 8, 9 and 10. A horizontal transparent plate 11 is provided at the upper portion of the housing 1. An original document 12 is closed adherence onto the original transparent plate 11 by an original document

cover 13. Light of an exposure lamp 14 is directed to the original document 12 through the transparent plate 11. A light image of the original document 12 is directed, through mirrors 16 and 17, a mirror lens 19 and a mirror 20 of an optical device 15, onto the surface of a photosensitive drum 21. Mirrors 22 and 23 are provided in the vicinity of the exposure lamp 14 so as to guide efficiently the light from the exposure lamp 12 onto the original document 12. At slit exposing, the exposure lamp 14, mirrors 16, 22 and 23 are displaced in moving direction 24, from a home position shown by a continuous line to a position 25 shown by a imaginary line. After the slit exposing, the exposure lamp 14, the mirrors 16, 22 and 23 are returned to the home position. The mirror 17 is displaced with the exposure lamp 14, the mirrors 16, 22 and 23, and is at a position 26 shown by a imaginary line when the exposure lamp 14, the mirrors 16, 22 and 23 are at the position 25. The light image of the original document 12 is directed onto the photosensitive drum 21 charged by a corona charger 27, and an electrostatic latent image is formed on the peripheral surface of the photosensitive drum 21. The electrostatic latent image is developed to a visible image by a developing device 28. The toner image on the surface of the photosensitive drum 21 is transferred by a transfer corona charger 29 to the copy paper sheets 4 and 5 being transported by a set

of transport rollers 10. The copy paper sheets 4 and 5 having the toner image are peeled certainly from the photosensitive drum 21 by a peel click 30 and a peel roller 31, and are transported to a heating and fixing device 32. The heating and fixing device 32 comprises a heating roller 34 having a heater 33 therein and a press roller 35 being hard contact with the heating roller 34. When the copy paper sheets 4 and 5 are transported between the heating roller 34 and the press roller 35 after the transfer step is performed, the toner on the copy paper sheets 4 and 5 are fused by heating and the fixing step is performed. After the fixing step is performed, the copy paper sheets 4 and 5 are discharged to a tray 38 provided at the side of the huosing 1 through a transport roller 36 and a discharger roller 37. The surface of the photosensitive drum 21 is cleaned by a cleaning device 39 after the transfer step is performed.

Fig. 2 is a side view of the fixing and heating device 32 according to the prevent invention, and Fig. 3 is a partial perspective view of the fixing and heating device 32. The fixing and heating device 32 is capable of being drawn out from the housing 1 of the electrostatic copying apparatus in a direction into the plane of Fig. 2.

Fig. 4 is a schematic longitudinal sectional view taken along a plane through the axes of the heating roller 34 and the press roller 35. A frame 42 of the fixing and heat-

ing device 32 is provided with the heating roller 34 and the press roller 35 which are paraleled and which have horizontal axes. The heating roller 34 is supported on the frame 42 of the fixing and heating device 32 to be rotated independently. The heater 33 is held in the heating roller 34 as above-mentioned. The press roller 35 is supported by a lever 46. An end of the lever 46 is supported on the frame 42 by a pin 48. The other end of the lever 46 is spring-biased by a spring 49 so as to cause the heating roller 34 to contact with the press roller 35. The transport path of the copy paper sheets is depicted by reference number 50 shown in Fig. 2. The copy paper sheets are transported in the direction of arrow 51 between the heating roller 34 and the press roller 35. The toner image corresponding to the original document 12 is fixed on the copy paper sheet transported between the heating roller 34 and the press roller 35. A scraper plate 52 is fitted downstream of the heating roller 34 in the direction of arrow 51 so as to scrape off the toner remaining on the surface of the heating roller 34 and to peel off the copy paper sheet tending to wind with the heating roller 34.

An end of the heating roller 34 has coaxially fixed thereto a sprocket wheel 54. The sprocket wheel 54 is driven to rotate by a main motor 56 through a chain 55. After a power switch is closed, the main motor 56 is operated while

copying operation is going on, and when a temperature of the heating roller 34 is between a temperature H3 and H2 as after-mentioned. Owing to the sprocket wheel 54 driven by the main motor 56, the heating roller 34 is driven to rotate in the direction of arrow 57 at a speed suitable for fixing and heating.

A temperature detecting element 58 such as a thermistor is attached to the periphery of the heating roller 34 at a central position in the axial direction of the heating roller 34 on the opposite side of the press roller 35. A surface temperature of the heating roller 34 is detected by the temperature detecting element 58.

Referring to Fig. 5, there is shown a schematic block diagram for driving and controlling the main motor 56. A signal from a power switch 59 of the electrostatic copying apparatus, an output from the temperature detecting element 58 and an output from a print button 60 pushed at time of copying operation are provided to a control circuit 61. The control circuit 61 controls the main motor 56, as being described in connection with next Fig. 6, in response to the outputs from the power switch 59, the temperature detecting element 58 and the print button 60. A fan 62 prevents a temperature in the housing 1 from rising abnormally by the heat from the exposure lamp 14 and the fixing and heating device 32.

The heating roller 34 and the photosensitive drum 21 is driven by the main motor 56 directly as above-mentioned, and the exposure lamp 14, the mirrors 16, 17, 22 and 23 are moved by the main motor 56 through a magnetic clutch.

Referring to Fig. 6, there is shown a surface temperature H of the heating roller 34 detected by the temperature detecting element 58 depended on the lapse of time. At a time t1, when the power switch 59 is closed, the heater 33 is energized electrically. Therefore, the temperature H of the heating roller 34 will be rising. Consequently, at a time t2 when the temperature H of the heating roller 34 has reached the temperature H3, the control circuit 61 drives the main motor 56. The temperature H3 is the same as or higher than a softening point Hl of the toner, for example 170°C, and is lower than the temperature H2 suitable for fixing and heating, for example 180°C. Owing to the main motor 56 being driven, the heating roller 34 and the press roller 35 are driven to rotate with the rotation speed suitable for fixing. As the heating roller 34 begins to be rotated at the time t2, the heat from the heating roller 34 is conducted to the press roller 35. Accordingly, the temperature H of the heating roller 34 is lowered from the time t2 to a time t3. On and after the time t3, the temperature of the heating roller 34 and the press roller 35 rises and reaches the temperature H2 suitable for fixing and heating

at a time t4. Thus, the heating roller 34 and the press roller 35 begin to rotate at the speed suitable for fixing and heating at the time t2, and stop to rotate at the time t4. According to experiments of the inventors, since the heating roller 34 stops to rotate in the period from t4 to t5, the temperature H of the heating roller 34 rises temporally. However, on and after the time t5, the temperature H of the heating roller 34 is uniformly maintained at the temperature H2 suitable for fixing and heating by means of the control circuit 61. Owing to the temperature H of the heating roller 34 rising temporally higher than the temperature H2 from the time t4 to the time t5 according to reduction of heat conduction from the heating roller 34 to the press roller 35, a temperature in the vicinity of the heating roller 34 rises rapidly. Therefore, on and after the time t5, the temperature H of the heating roller 34 is stably maintained at the temperature H2 suitable for fixing.

Since the main motor 56 begins to drive at the time when the temperature H of the heating roller 34 becomes the temperature H3 of the same as or higher than the softening point H1 of the toner, the heating roller 34 and the press roller 35 are driven to rotate by the main motor 56. At this time, the toner which has adhered to the heating roller 34 and the press roller 35 softens. Accordingly, the heating roller 34 and the press roller 35 are not injured and the

scraper plate 52 is not injured.

The temperature H3 is chosen so that the period from the time t2 to the time t4 is as short as possible. Namely, the temperature H3 is chosen so that the temperature of overall surfaces of the heating roller 34 and the press roller 35 becomes uniform at t4 when the temperature H of the heating roller 34 reaches the temperature H2, after the heating roller 34 and the press roller 35 have been rotated in as short a period as possible. Since the period from t2 to t4 is chosen as short as possible as above-mentioned, occurrence of the noise is decreased and the electric power consumption of the main motor 56 is decreased.

When at the time t6 the print button 60 is pushed and copying operation is begun, from a time t6 to a time t7 in copying operation the main motor 56 is driven sequentially. Therefore, the photosensitive drum 21 is rotated by the power of the main motor 56, and the exposure lamp 14, the mirrors 16, 17, 22 and 23 are displaced so as to performed the slit exposing. The heating roller 34 and the press roller 35 are always rotated while the main motor 56 is driven. Accordingly, at the time when the transfered copy paper sheets pass through between the heating roller 34 and the press roller 35, the surface temperature of the heating roller 34 and further more the press roller 35 have a distribution of the uniform temperature

H2 suitable for fixing and heating. Therefore, the advantageous fixing is performed.

According to another embodiment of the invention, the temperature detecting element 58 may be provided with relation to the press roller 35.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

CLAIMES

1. A fixing and heating device of an electrostatic copying apparatus for fixing a toner image onto a copy paper sheet, by transporting the copy paper sheet having the toner image through a set of fixing rollers which are a heating roller and a press roller and have temperature suitable for fixing, characterized by a temperature detecting element 58 for detecting a temperature H of the fixing rollers 34, 35, a heater 33 for heating the fixing rollers 34, 35, means for driving the fixing rollers 34, 35 to rotate at a speed suitable for the fixing, and means for controlling the means for driving the fixing rollers 34, 35 so as to energize the heater 33 in response to closing of a power switch and so as to drive the means for driving the fixing rollers 34, 35 in response to an output of the temperature detecting element 58 from the time when the temperature H of the fixing rollers 34, 35 reaches a predetermined temperature H3 to the time when the temperature H of the fixing rollers 34, 35 reaches a temperature H2 suitable for fixing, and while copying operation is going on after the temperature H of the fixing rollers 34, 35 has reached the temperature H2, wherein the temperature H3 is the same as or higher than a softening temperature H1 of toner and is lower than the temperature H2.

2. A fixing and heating device of an electrostatic copying apparatus according to claim 1, characterized in that the temperature detecting element 58 is attached to the periphery of the heating roller 34 at a central position in the axial direction of the heating roller 34 at the opposite side of the press roller 35.

3. A fixing and heating device of an electrostatic copying apparatus according to claim 1, characterized in that the means for controlling the means for driving the fixing rollers 34, 35 controls the means for driving the fixing rollers34, 35 in response to a signal from the power switch, an output from the temperature detecting element 58 and a signal from a print button 60 pushed at the beginning of copying operation.

4. A fixing and heating device of an electrostatic copying apparatus according to claim 2, characterized in that the temperature detecting element 58 is a thermistor.

Fig. 1

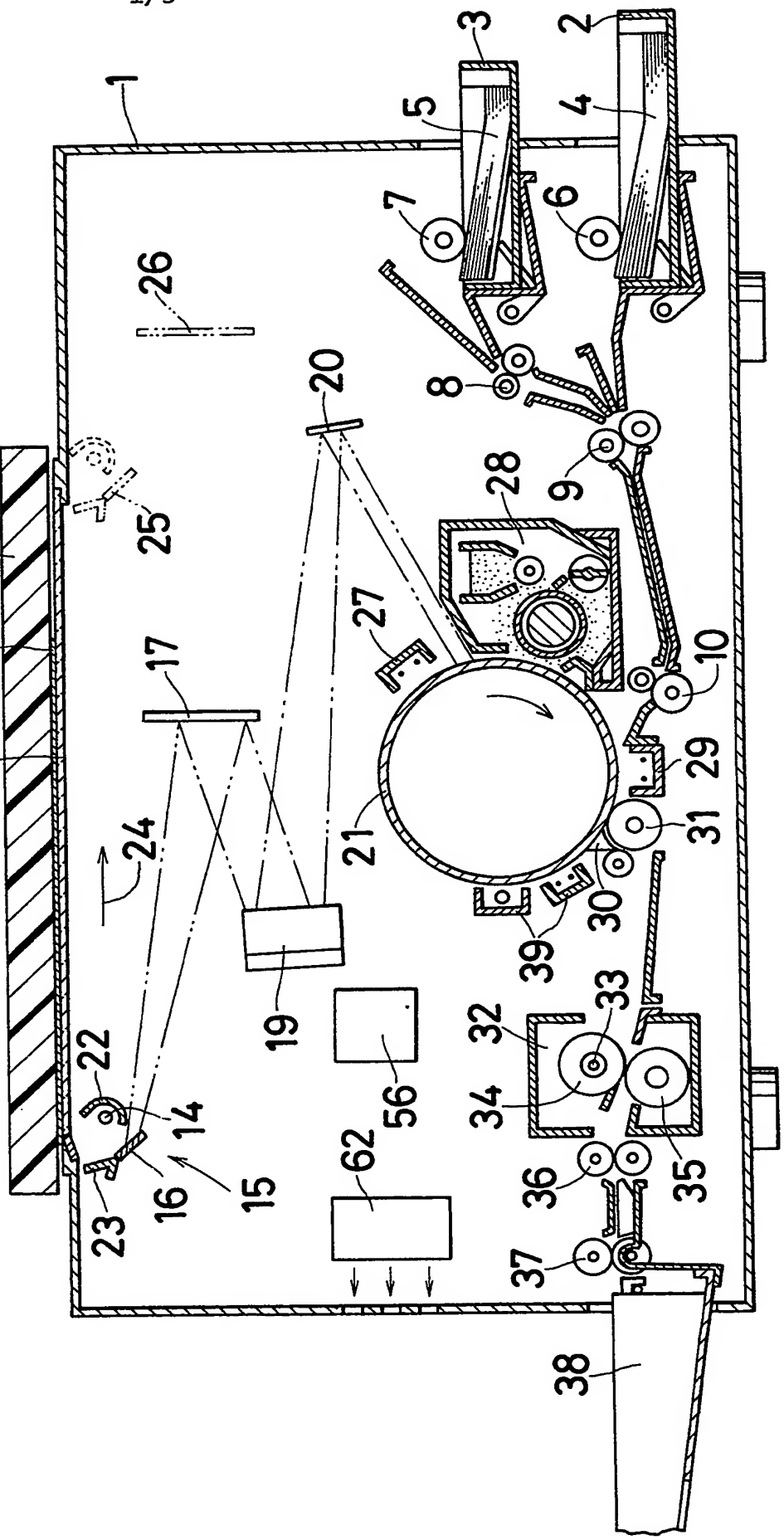

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
56
62

Fig. 2

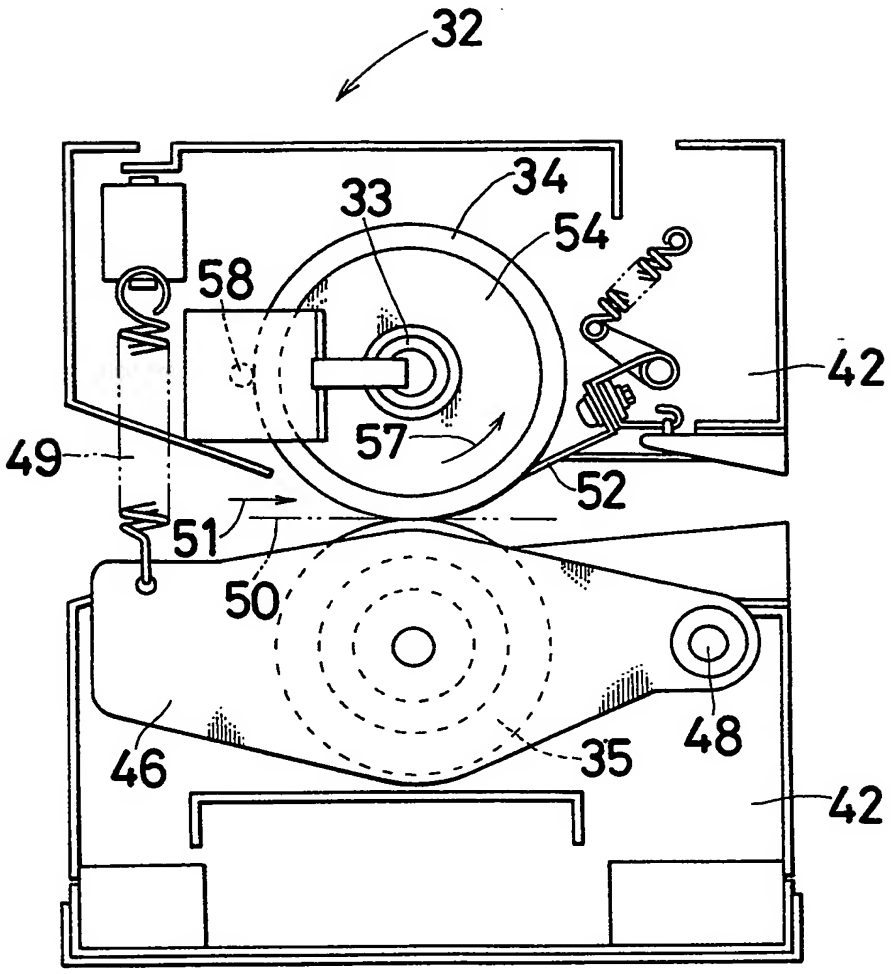


Fig. 3

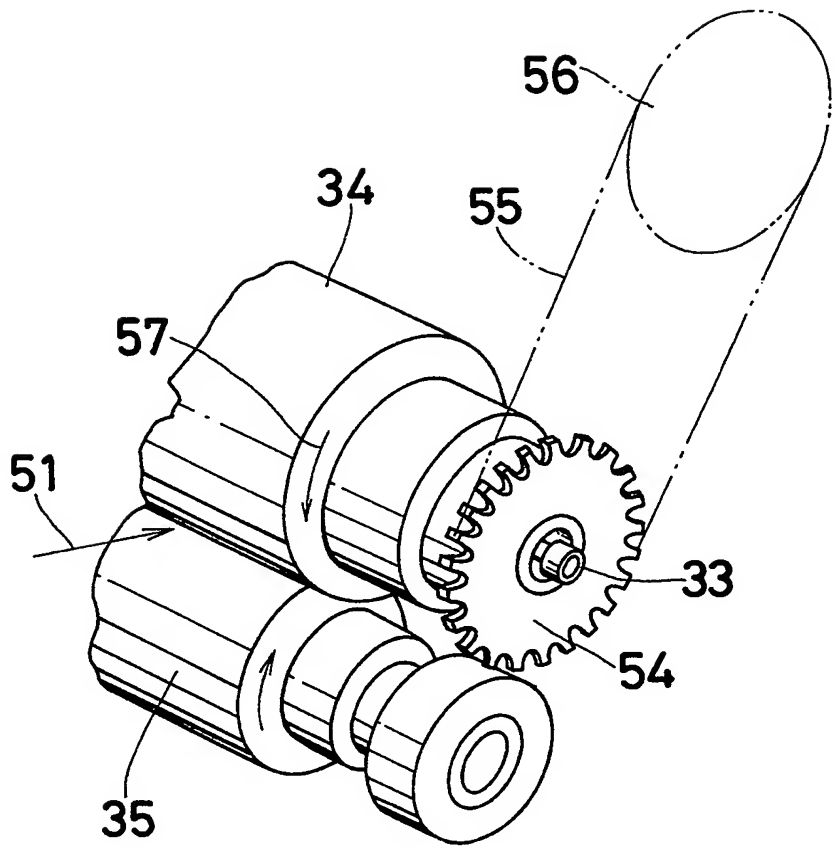


Fig. 4

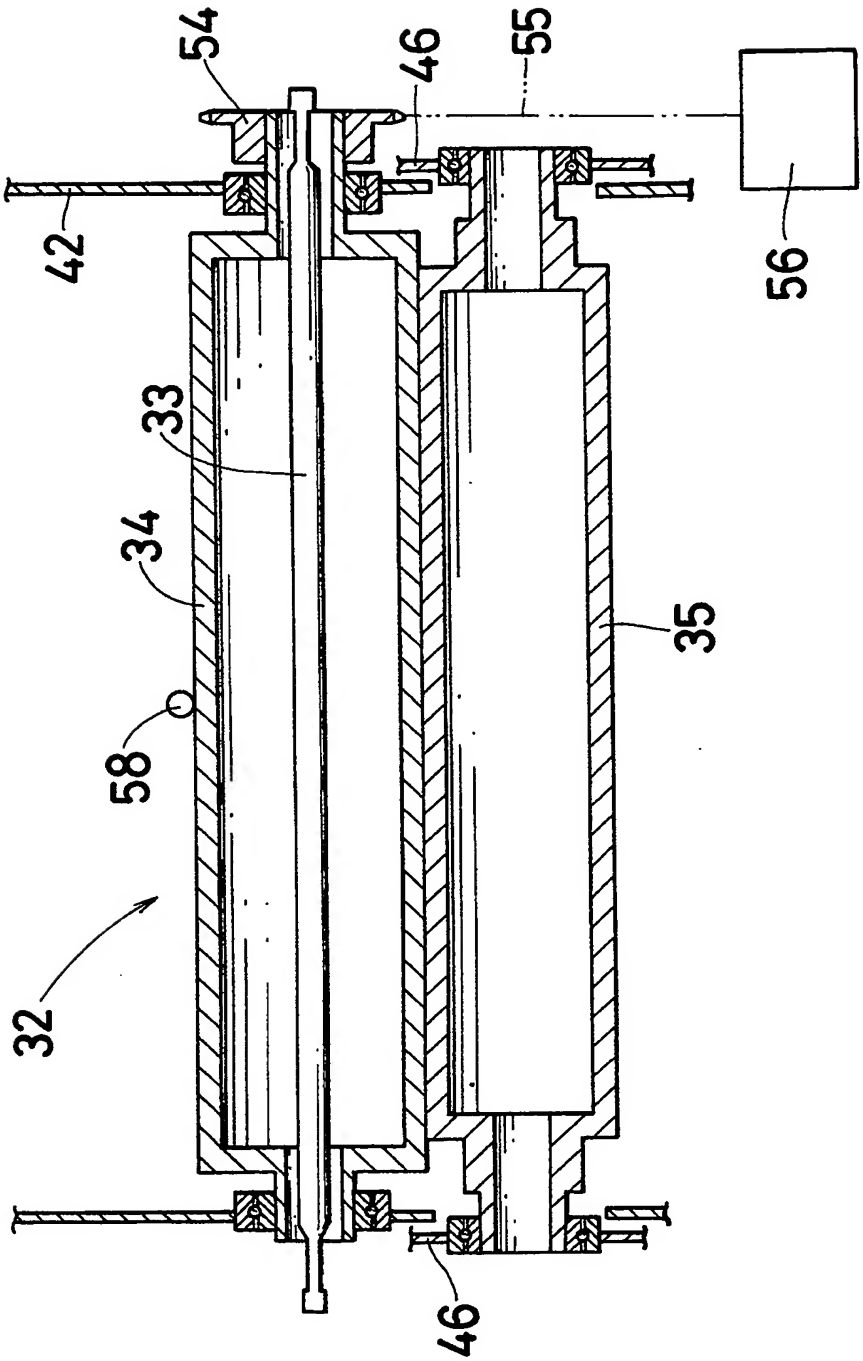


Fig. 5

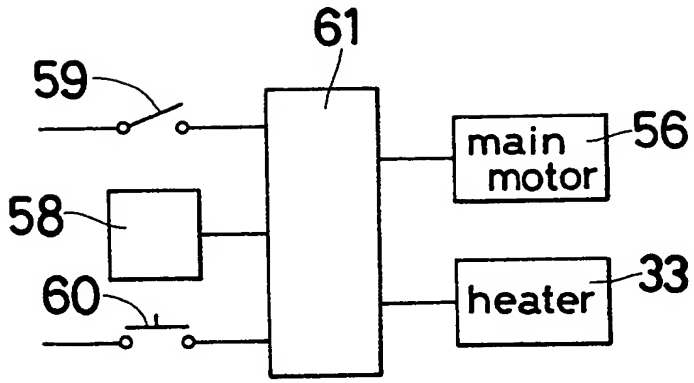
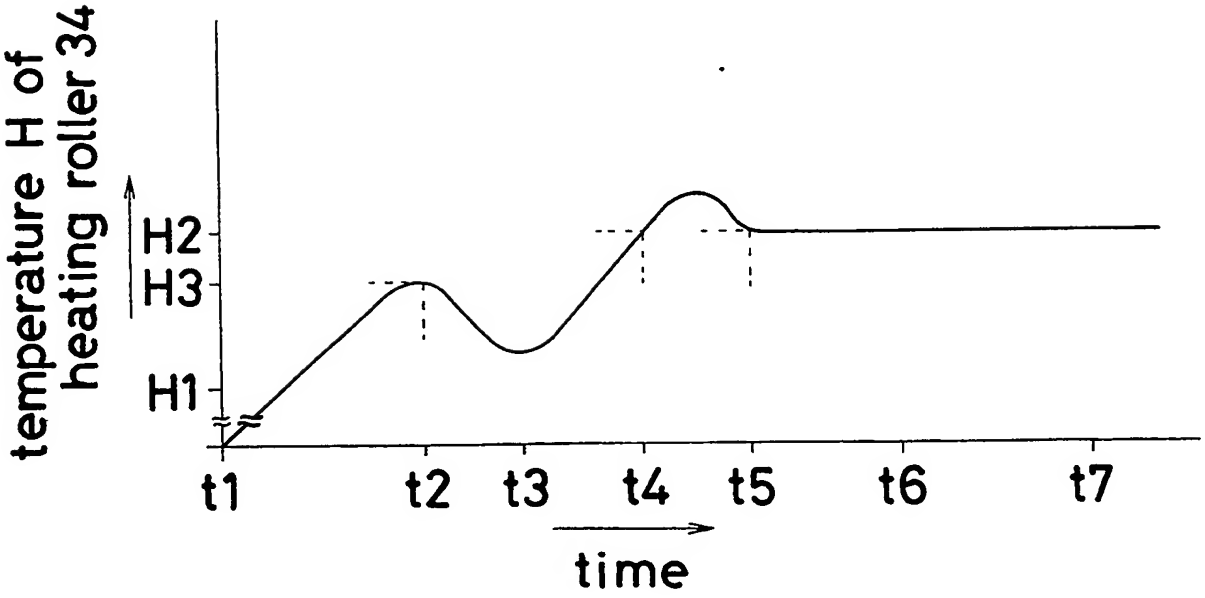

61
59
main motor
56
58
60
heater
33

Fig. 6


temperature H of heating roller 34
H2
H3
H1
t1
t2
t3
t4
t5
t6
t7
time